The Mid-Summer Drought over Central America

Paper-writing Workshop on the Analysis of CORDEX-CORE Climate Projections

Arturo Corrales Suastegui[1] Edgar Gerardo Pavía López[1] Ramón Fuentes Franco[2]

[1]CICESE, [2]SMHI,

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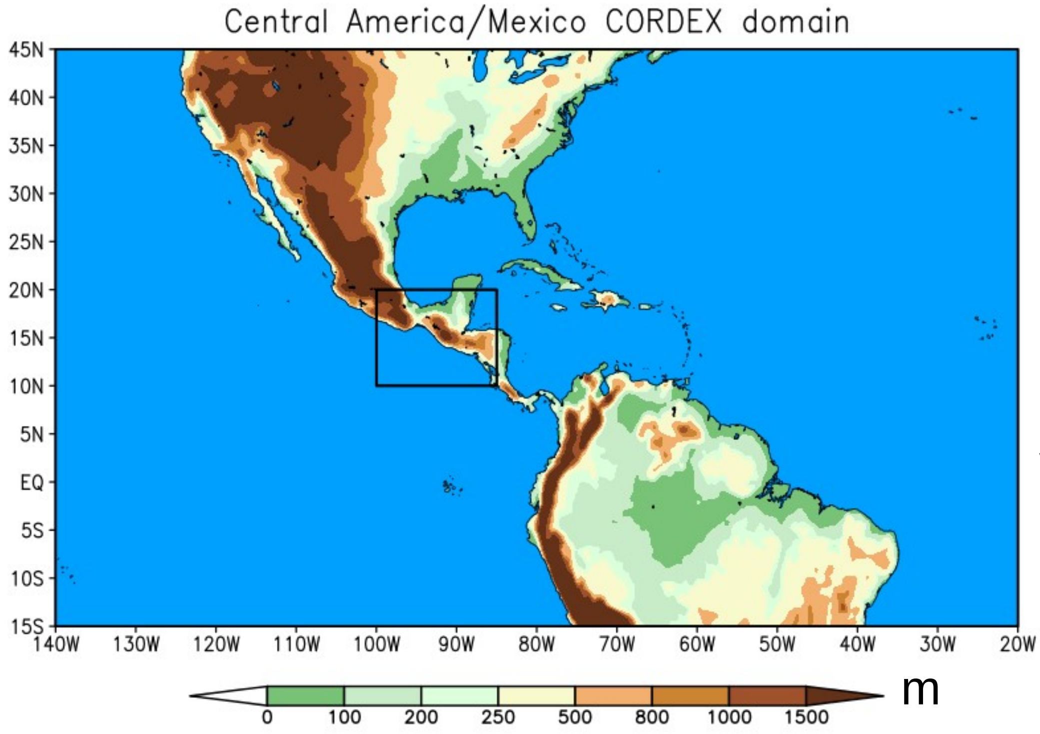
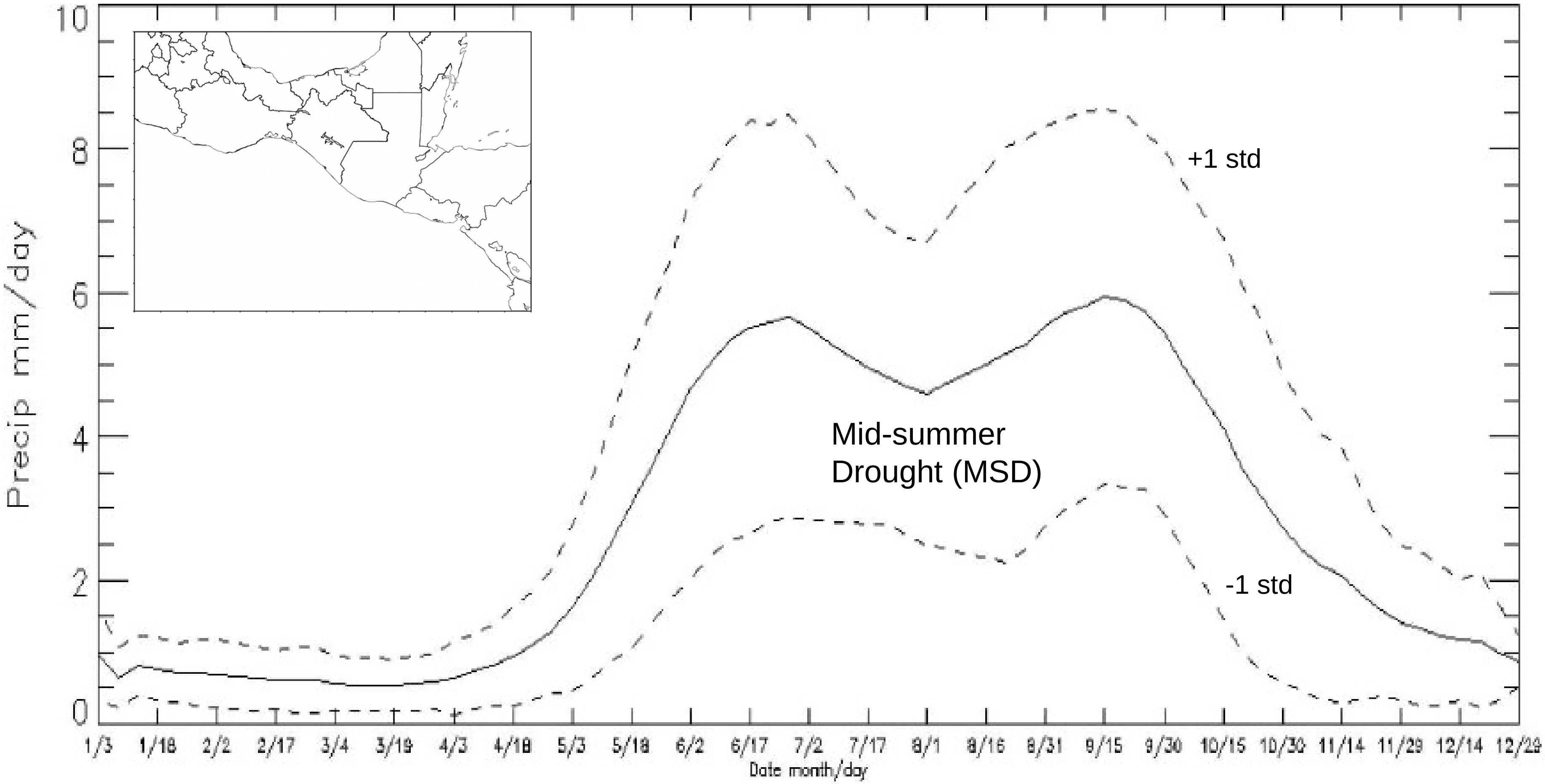
Introduction



The enhanced differential warming between the Pacific (PO) and Atlantic Oceans (AO) (PO-AO) towards the end of the century, which might cause a strengthening of the westward Caribbean Low-Level Jet (CLLJ), which in turn might carry precipitation towards the ocean leading to severe drought over the SMCA region.

Introduction

Climatology of precipitation (1979-2003)



Small *et al.* (2007)

Methods

-Precipitation Data
Monthly fields from two datasets: CRU and CHIRPS

-Model
ICTP Regional Climate Model (RegCM4)

Central America domain (CORDEX)

-Simulations

Reference (1976-2005) and future periods (2070-2099)

RegCM4 driven by ERA-Interim as an evaluation of the model (M0) (1981-2015)

Methods

To analyze simulations driven by three GCMs from the CMIP5

1. Met Office Hadley Centre MOHC-HadGEM2-ES (M1),
2. Max Planck Institute for Meteorology (MPI-M) M-MPI-ESM-MR (M2),
3. NOAA-Geophysical Fluid Dynamics Laboratory NOAA-GFDL-ESM2M (M3),

	Reference	Future	
		RCP2.6	RCP8.5
M1	x	x	x
M2	x	x	x
M3	x	x	x

Table 1.

Methods

-The MSD

To decide whether or not a year presented a MSD condition we followed a criterion similar to that of Karnauskas et al. (2013); that is, considering monthly data, we decided on a MSD season when there were two precipitation peaks separated from each other by one to three months (the relative dry months). If there were three precipitation peaks (two next to each other), the third precipitation peak should be separated by at least two, and up to four months, from the first peak; otherwise the year was considered as a No-MSD.

Methods

-The MSD

We define three quantities:

1) The annual intensity (*I*)

$$I_k = \begin{cases} 1 - \frac{2Pp_k^2}{mPp_k^1} & for MSD year \\ 0 & for No - MSD year \end{cases}$$

where k = 1, 2, ..., n is the year, m = 1, 2, 3, is the length of the relative dry period, Pp^1 is the sum of the precipitation of the two peaks bordering the relative dry months, and Pp^2 is the total precipitation during the relative dry months.

Methods

2) The Frequency (*F*)

$$F = \frac{1}{25}\sum_{k=1}^{25}(Oc_k) * 100$$

where Oc_k is the occurrence in year k (Oc_k = 1 for MSD years, and Oc_k = 0 for No-MSD years).

3) The area coverage (*Ar*)

$$Ar_k = \frac{1}{p}\sum_{i=1}^{p}\left(Oc_k^i\right) * 100$$

where i = 1, 2, ..., p is the grid point number, and p is the total number of grid points.

Methods

-Ensembles

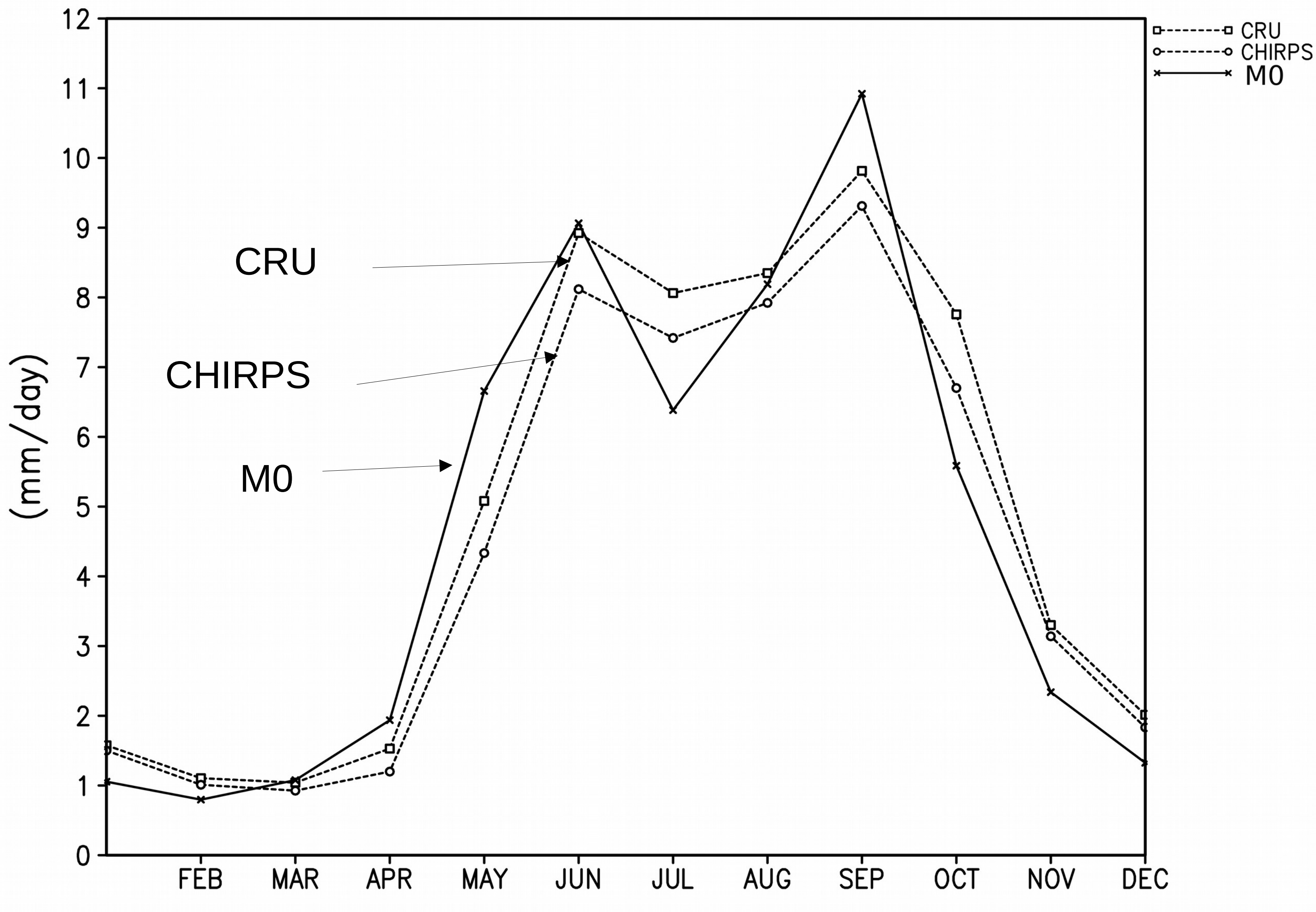
To define ensembles of precipitation, SST and zonal wind at 850 hPa (u850) by averaging the corresponding monthly fields of the simulations in Table 1 (Eref, Ercp2.6 and Ercp8.5).

From the precipitation ensembles we will calculate the annual cycle, *I*, *F* and *Ar*.

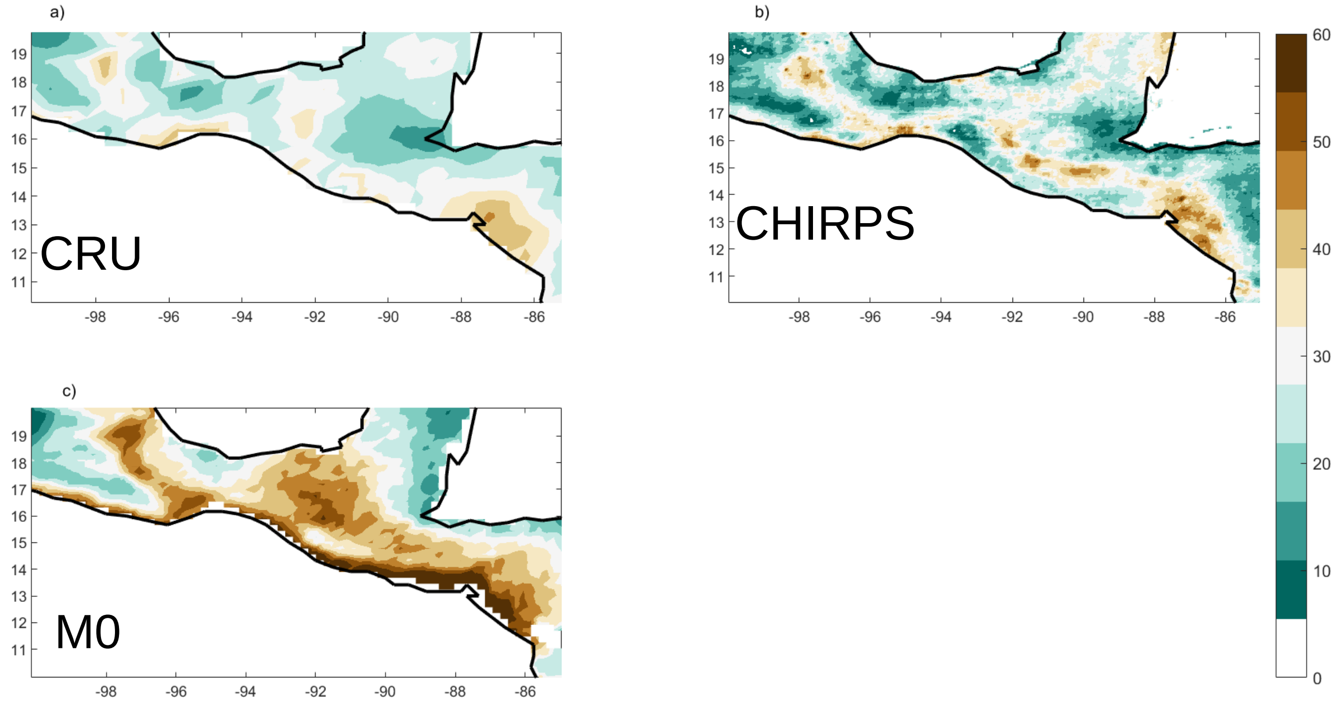
Preliminary results of the evaluation of the model (M0)

(1981-2015)

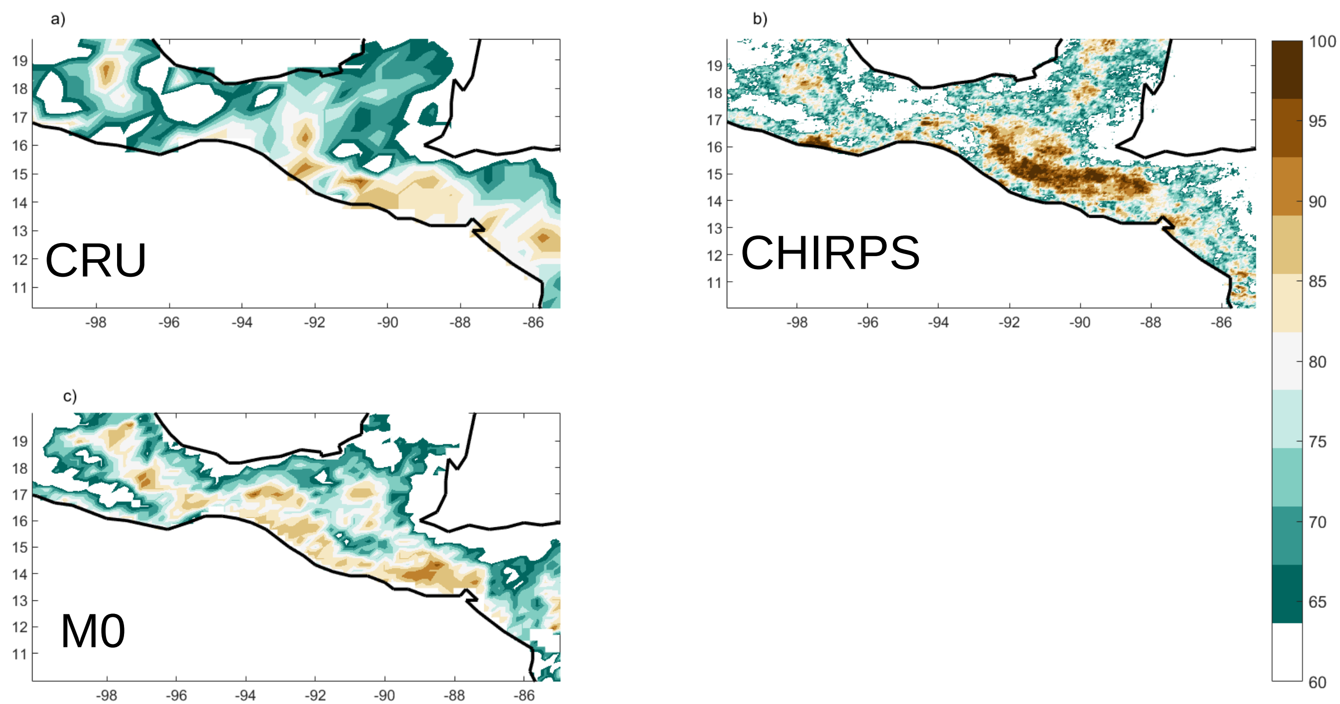
RegCM4 driven by EIN75
Precipitation (mm/d)

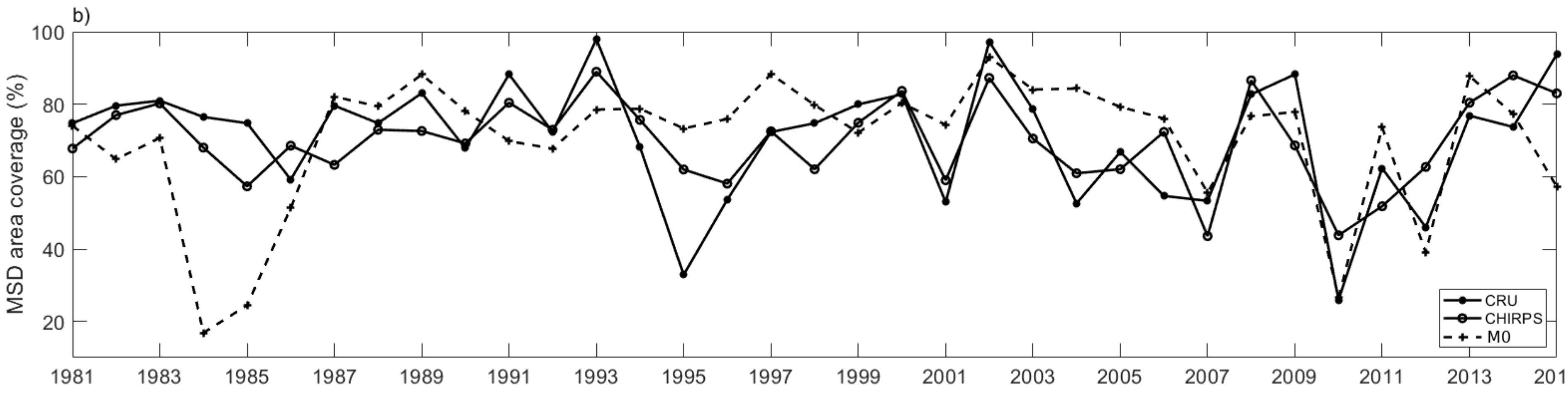


Spatial distribution of MSD *I*



Spatial dsitribution of MSD *F* (%)



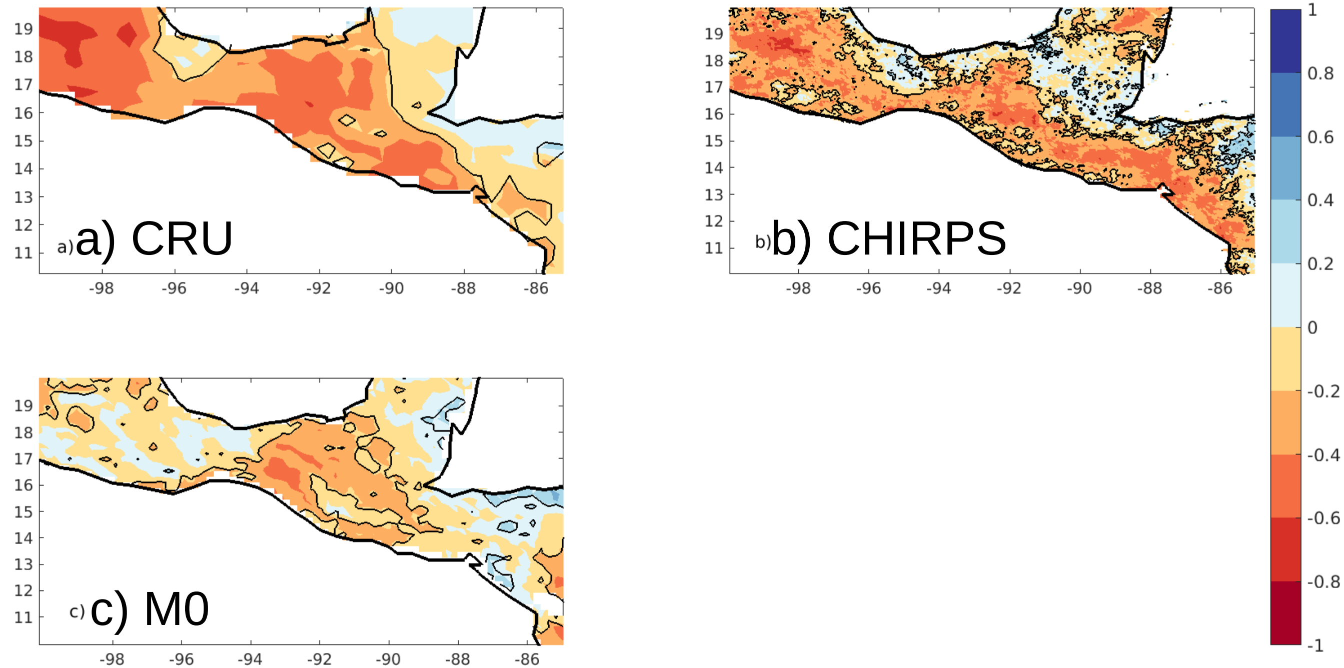


	CRU	CHIRPS	M0
m (%)	71	70	70
std (%)	16	11	18

Correlation between intensity and the seasonal mean MJJASO of iCLLJ index during the evaluation period.

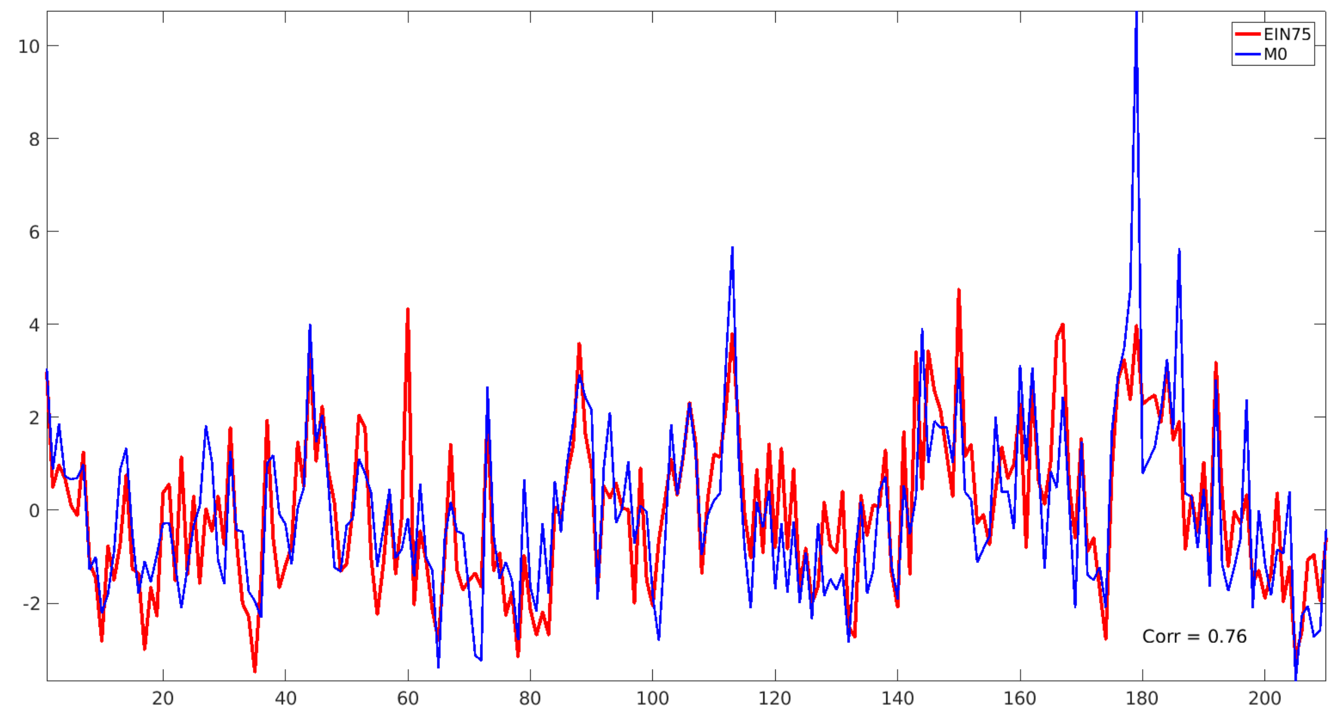
a) CRU, b) CHIRPS and c) M0 are the correlation I-iCLLJ.

Black contours are significant correlations.

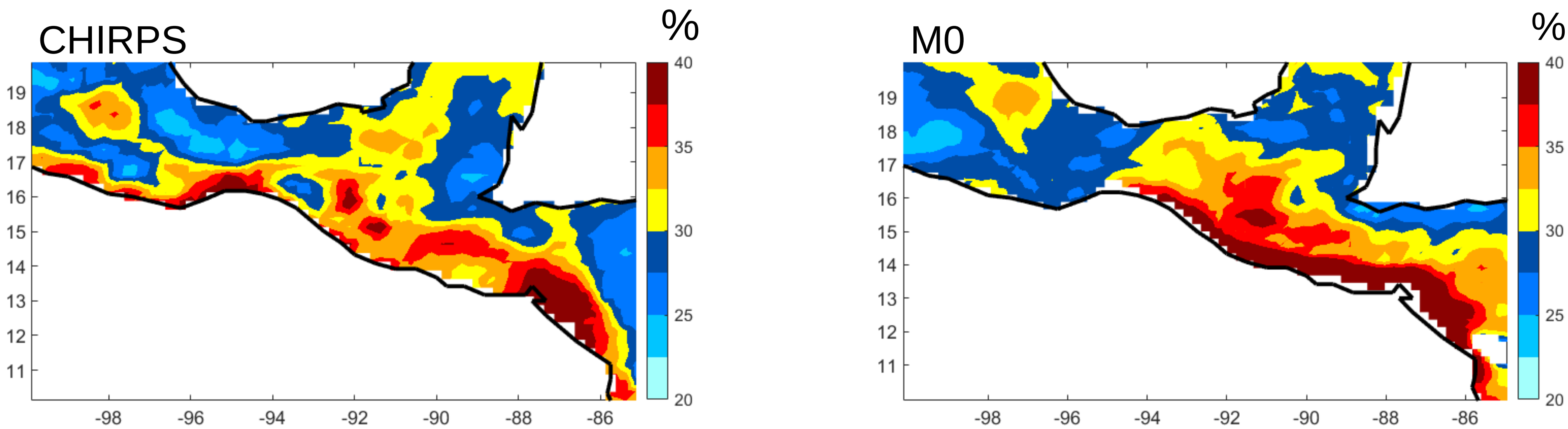


iCLLJ index.

EIN75 (red)
M0 (blue)



The observations show that the intraseasonal precipitation variability accounts for nearly 40% of the total variability of precipitation along the Pacific coast and some regions of south-central Mexico and ~30% over Yucatan peninsula.



The ratio between the standard deviation of 20-80 day filtered MJJASO precipitation to standard deviation of the unfiltered precipitation.

Global distribution of locations with biannual cycle of precipitation

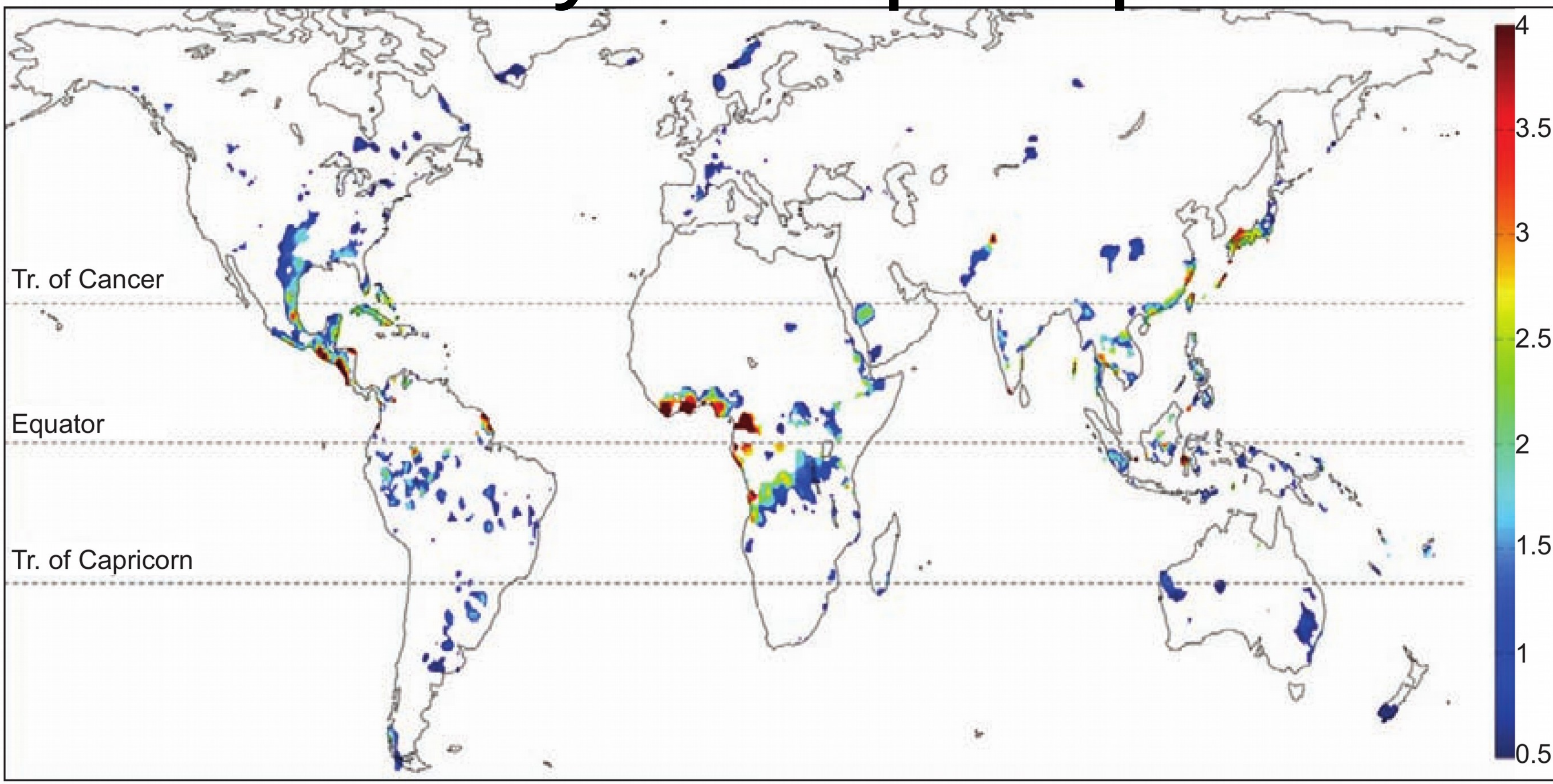


Fig. 3. Global distribution of locations objectively determined to exhibit a mean biannual cycle of precipitation based on the NOAA PREC/L data set (gridded station and satellite blend, land only, 0.5º resolution, 1948-2007). Plotted is the difference between the mean of the two relative maxima and the relative minimum (mm/day), calculated according to the MESA algorithm illustrated in Figure 1.

Karnauskas *et al.* 2013

The Bimodal Precipitation Distribution in the Upper Midwest

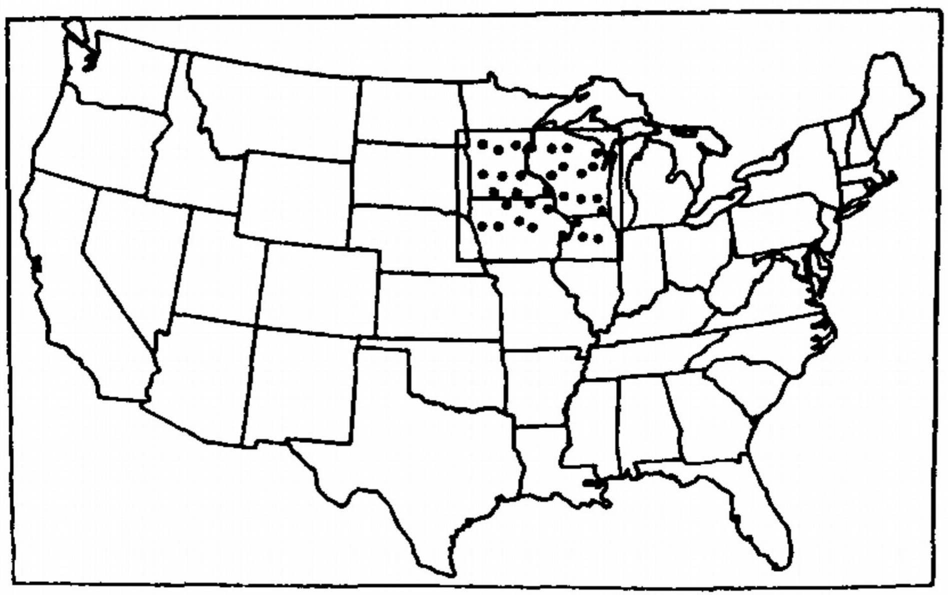


FIG. 3. Study area and climate stations used in the analysis.

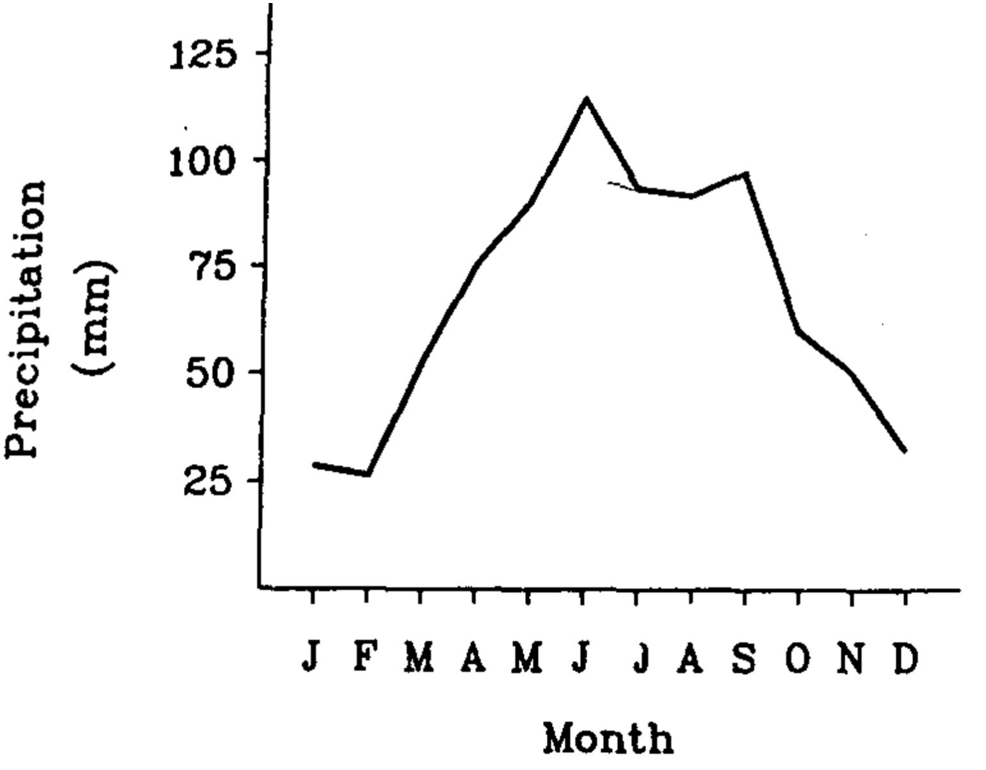


FIG. 1. Mean monthly precipitation in the Upper Midwest, 1925–1979.

Keables, Michael J. 1989


Thanks